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PHY 106



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## UNIVERSITY EXAMINATIONS

### 2017 /2018 ACADEMIC YEAR

FIRST YEAR SECOND SEMESTER REGULAR EXAMINATION

**FOR THE DEGREE OF BACHELOR OF SCIENCE  
IN MICROBIOLOGY**

**COURSE CODE: PHY 106**

**COURSE TITLE: PHYSICS FOR LIFE SCIENCES II**

**DATE: 23<sup>rd</sup> APRIL, 2018**

**TIME: 9AM – 12.00 NOON**

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#### INSTRUCTION TO CANDIDATES

- SEE INSIDE

**THIS PAPER CONSISTS OF 5 PRINTED PAGES**

**PLEASE TURN OVER**

PHY 106  
PHY 106: PHYSICS FOR LIFE SCIENCES II

STREAM: BSC (MIC)

DURATION: 3 Hours

**INSTRUCTIONS TO CANDIDATES**

- i. Answer Question **ONE** and **TWO** in **SECTION A** and any other **THREE** questions in **SECTION B**.
- ii. Do not write on the question paper.

**SECTION A (24 Marks)**

**QuestionOne (12 Marks)**

- (a) Calculate the range of wavelength for visible light in the frequency range between  $4.0 \times 10^{14}$  Hz (red) and  $7.9 \times 10^{14}$  Hz (violet). Express the answers in nanometers (nm). (4 Marks)
- (b) Define the term reflectivity (1 Marks)
- (c) Find the image formed by a converging lens of focal length 35 mm when the object is placed 85 mm from the lens. (4 Marks)
- (d) If the distance to the retina is 2 cm and the relaxed focal length of the eye's lens is 1.96 cm, calculate the range of vision assuming that the focal length can change by 8%. What lens strength in dioptries would be required to correct the vision? (3 Marks)

**Question Two (12 Marks)**

- (a) The objective of a compound microscope has the focal length of  $f_o = 0.40$  cm, while the eye piece is  $f_e = 03.0$  cm. the two lenses are separated by a distance of  $L = 20.0$  cm. A person with normal eyes is using the microscope.
  - i) Determine the angular magnification of the microscope. (5 Marks)
  - ii) Compare the answer in a(i) with the largest angular magnification obtainable by using the eyepiece alone as magnifying glass. (3 Marks)

- (b) The house hold ac supply in Kenya is 240 V. If the wiring in the house has a maximum current of 15 A, can a 1200 W electric heater, a 100 W light bulb and a grill with electrical resistance of 20  $\Omega$  be operated simultaneously? (4 Marks)

**SECTION B (36 Marks)**



**Question Three (12 Marks)**

- (a) An electrical heater with resistance  $12\Omega$  is connected to the 240 V circuit. Find the rate of heat production. (3 Marks)
- (b) A piece of wood from the ruins of an ancient dwelling was found to have a  $^{14}\text{C}$  activity of 13 disintegrations per minute per gram. The activity of the living wood is 16 disintegrations per minute per gram. What was the lifespan of the tree from which the wood sample was extracted from? Half life is 5670 years. (4 Marks)
- (c) Discuss the three postulates used to explain the Bohr's atomic model. (3 Marks)
- (d) Two lenses of compound microscope have their focal lengths as  $f_1 = 10\text{cm}$  and  $f_2 = 10\text{mm}$ . Which of the two lenses is more powerful and why? (2 Marks)

**Question Four (12 Marks)**

- (a) State the thin lens equation, defining each and every symbol used (2 Marks)
- (b). A ray of light strikes a flat, 2.00 cm thick block of glass ( $n = 1.50$ ) at an angle of  $30^\circ$  with respect to the normal.
- (i) Find the angle of refraction at the top surface. (3 Marks)
- (ii) Find the angle of incidence at the bottom surface and the refracted angle at this surface. (3 Marks)
- (c) Mention four fundamental components of NMR apparatus (4 Marks)



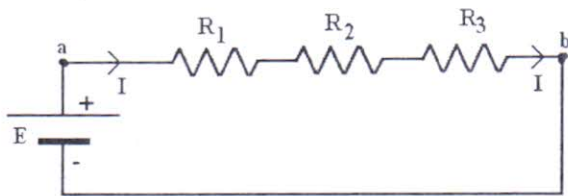
**Question Five (12 Marks)**

- (a). What is meant by the term half-life as used in capacitors? (1 Mark)
- (b). A capacitor of capacitance  $10 \mu\text{F}$  is fully charged from a  $20 \text{ V}$  dc supply. Determine:
- The charge stored in the capacitor (3 Marks)
  - The energy stored by the capacitor (2 Marks)
  - The total charge stored if two capacitors of the above kind and value are arranged in parallel to each other and connected to a  $20 \text{ V}$  d.c supply (3 Marks)
  - The total charge stored if two  $10 \mu\text{F}$  capacitors are arranged in series to each and connected to a  $20 \text{ V}$  d.c supply. (3 Marks)

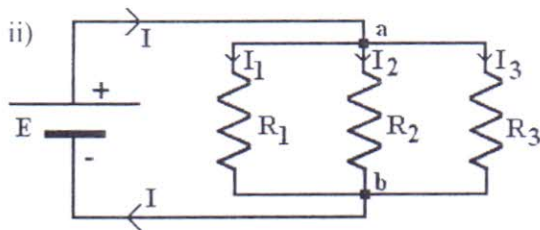
**Question Six (12 Marks)**

- a) Derive the expression for effective resistance ( $R_T$ ) of the resistors  $R_1$ ,  $R_2$  and  $R_3$  in series and parallel circuits shown below: (6 Marks)

i)



ii)



- (b) Show that the work-done in increasing the charge in a capacitor  $C$  which is connected to a potential difference  $V$  is given by  $W = \frac{1}{2} CV^2$  (3 Marks)
- (c) Differentiate between Specular reflection and Diffuse reflection (2 Marks)

(d) Mention two ways in which spherical aberration could be minimized (2 Marks)

(e) The domestic electrical appliances usually have three wires for connecting them to the mains electricity. Describe the three wires. (3 Marks)

**Question Seven (12 Marks)**

(a) With the aid of a schematic set-up of a cathode ray oscilloscope, discuss its working principle. (5 Marks)

(b) Mention two uses of cathode ray oscilloscope. (2 Marks)

(c) State two safety features of a socket (2 Marks)

(d) Magnetic materials are classified into three broad classes Ferromagnetic, Diamagnetic and Paramagnetic. Differentiate the three categories (3 Marks)

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